

WHAT IS CLAIMED IS:

1. A gradient copolymer comprising at least two monomers, the first (M_1), the homopolymer of which 5 corresponding to a Tg_1 of less than 20°C, representing at least 50% by weight of the total weight of the copolymer, the second (M_2), the homopolymer of which corresponding to a Tg_2 of greater than 20°C and preferably of greater than 10 50°C, representing at most 50% by weight of the total weight of the copolymer, at least one of the monomers having to be hydrophilic and represent at least 15 5% by weight of the total weight of the copolymer, characterized in that it comprises at least one monomer M_i such that the probability of encountering M_i in any standardized position x situated on the polymer chain is nonzero.
2. The copolymer as claimed in claim 1, characterized 20 in that Tg_1 is between -150 and 20°C and preferably between -120 and 15°C.
3. The copolymer as claimed in claim 1 or 2, characterized 25 in that it exhibits average masses of between 5000 g/mol and 1 000 000 g/mol and exhibits polydispersity indices of between 1.1 and 2.5, preferably between 1.1 and 2.
4. The copolymer as claimed in one of the preceding 30 claims, characterized in that the hydrophilic monomer represents at least 10% by weight of the total weight of the copolymer.
5. The copolymer as claimed in one of the preceding 35 claims, characterized in that the hydrophilic monomer is chosen from the group consisting of:
 - ethylenic carboxylic acids, such as acrylic acid, methacrylic acid, itaconic acid or fumaric

acid,

- acrylates and methacrylates of polyethylene glycol or of glycol which are or are not substituted on their end functional group by alkyl, phosphate, phosphonate or sulfonate groups,
- 5 - amides of unsaturated carboxylic acids, such as acrylamide or methacrylamide and their N-substituted derivatives,
- aminoalkyl acrylates and methacrylates, and 10 aminoalkylmethacrylamides,
- carboxylic anhydrides carrying a vinyl bond, such as maleic anhydride or fumaric anhydride,
- vinylamides, such as vinylpyrrolidone or vinyl-acetamide,
- 15 - vinylamines, such as vinylmorpholine or vinylamine,
- vinylpyridine.

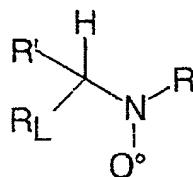
6. The copolymer as claimed in one of claims 1 to 5, 20 characterized in that the monomer M_1 is chosen from the following monomers:

- linear or branched C_1-C_{12} alkyl acrylates,
- polyethylene glycol acrylate or (meth)acrylate,
- dienes, such as butadiene or isoprene.

25 7. A process for producing a gradient copolymer by the solution or bulk controlled radical polymerization, at a temperature of between 10 and 160°C and preferably between 25 and 130°C, in the presence of a radical polymerization initiator and of an agent for controlling the polymerization, of a mixture of monomers comprising at least two monomers, the first (M_1), the homopolymer of which 30 corresponding to a T_{g1} of less than 20°C, preferably of between -150 and 20°C and more preferably still of between -120 and 15°C, representing at least 50% by weight of the total 35 weight of the mixture, the second (M_2), the homopolymer of which corresponding to a T_{g2} of

greater than 20°C and preferably of greater than 50°C, representing at most 50% by weight of the total weight of the mixture, at least one of the monomers having to be hydrophilic and represent at 5 least 5% by weight of the total weight of the mixture.

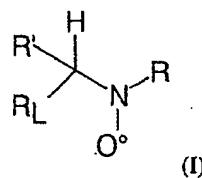
8. The process as claimed in claim 7, characterized in that the agent for controlling the 10 polymerization is a nitroxide of general formula:

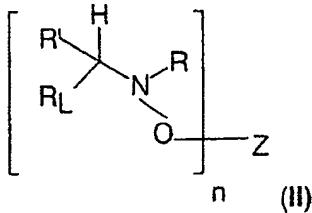


15 - where R' and R, which are identical or different and which are optionally connected so as to form a ring, are alkyl groups having between 1 and 40 carbon atoms which are optionally substituted by hydroxyl, alkoxy or amino groups; preferably, R and R' are tert-butyl groups;

20 - and where R_L is a monovalent group with a molar mass of greater than 16 g/mol which can be a phosphorus group or an aromatic group.

9. The process as claimed in claim 7, characterized 25 in that the polymerization initiator and the control agent are advantageously replaced by a mixture composed of alkoxyamine corresponding to the following general formula (II) and of nitroxide corresponding to the general 30 formula (I):





in which:

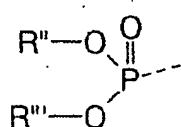
5 - n is an integer of less than or equal to 8 and
preferably of between 1 and 3,

10 - Z is a carrying monovalent or polyvalent
radical of styryl, acryloyl or methacryloyl type,

15 - where R' and R, which are identical or
different and which are optionally connected so
as to form a ring, are alkyl groups having
between 1 and 40 carbon atoms which are
optionally substituted by hydroxyl, alkoxy or
amino groups; preferably, R and R' are tert-
butyl groups;

20 - and where R_L is a monovalent group with a molar
mass of greater than 16 g/mol which can be a
phosphorus group or an aromatic group,
the nitroxide (I) representing from 0 to 20% by
weight of the total weight of the mixture.

20. The process as claimed in claim 8 or 9,
characterized in that, in particular, R_L is a
phosphorus group and more particularly a
phosphonate group of formula:



30 - where R'' and R''', which are identical or different and which are optionally connected so as to form a ring, are alkyl groups having between 1 and 40 carbon atoms which are optionally substituted by hydroxyl, alkoxy or amino groups;

in particular, R'' and R''' are ethyl groups; the nitroxide (I) representing from 0 to 20% by weight of the total weight of the mixture.

5 11. A process for the aqueous dissolution, according to the following stages, of the gradient copolymers of claims 1 to 6 or capable of being obtained according to the process of claims 7 to 10:

10 1) the copolymer is dissolved in a ketone solution, such as acetone or methyl ethyl ketone (MEK), at a level of solid of between 20 and 90%, preferably between 20 and 50%,

15 2) the solution obtained in 1 is neutralized, if necessary, by addition of a molar solution either of acid or of base, the acid or base choice being conditioned by the chemical nature of the hydrophilic monomer,

20 3) water is then added, with vigorous stirring, to the solution obtained in 1 or optionally in 2 in a proportion such that the level of solid obtained is between 1 and 80%; optionally, the water can be replaced by water/alcohol mixtures in proportions ranging from 99/1 to 50/50;

25 4) the ketone is evaporated until the desired level of solid is obtained.

12. An aqueous solution, obtained according to the process of claim 11.

30 13. The use of the gradient copolymer of claims 1 to 6 or capable of being obtained according to the process of claims 7 to 10 in formulations for paints, adhesives or glues and in cosmetic formulations.

35 14. The use of the gradient copolymer of claims 1 to 6 or capable of being obtained according to the process of claims 7 to 10 for pigment dispersion.

15. The use of the aqueous solution of claim 12 in formulations for paints, adhesives or glues and in cosmetic formulations.

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16. The use of the aqueous solution of claim 12 for pigment dispersion.